Ecocycle

newsletter on life-cycle tools, management and product policy.

Winter 1995 Issue no. 1

on the inside

welcome

WELCOME TO THE FIRST ISSUE OF *Ecocycle*, A NEWSLETTER that shares information on policy and technical issues related to life-cycle management (LCM) tools. We hope you'll find it a valuable source of LCM ideas and information.

You may already be familiar with life-cycle assessment (LCA), an LCM tool with a rather coloured history — it's been widely associated with the promotion of the "environmental superiority" of particular products or packaging systems. Despite the cynicism such applications create, the idea of reducing the environmental burden associated with a product throughout its life-cycle has survived and thrived.

Life-cycle thinking has penetrated environmental management schemes, including environmental management systems for industry, extended producer responsibility and product stewardship initiatives, pollution prevention strategies, toxic management policies, green procurement guidelines, and eco-labelling programs.

Industry itself is taking significant steps, through development of international standards, to guide the appropriate use of LCA. Governments are embracing life-cycle management at a furious pace. Why all of this sudden activity?

One reason is the simple logic of the life-cycle approach. It recognizes that all stages in a product's production, use and disposal have associated environmental impacts. Narrow solutions run the risk of simply transferring impacts to another stage in the life-cycle. Using the life-cycle approach, manufacturers can start incorporating environmental considerations into their products right at the design table.

A second reason is the potential for win-win opportunities for industry. Many believe that by adopting LCM tools, industry can improve both its environmental performance and its economic efficiency.

A final reason hinges on the trade and market-share implications of *not* taking a life-cycle management approach. International and national standards now being developed in this area will favour companies that adopt LCM tools, and increasingly, downstream customers and consumers are requiring suppliers to show commitment to improved environmental performance.

Ecocycle will report on international activity, as well as activities of national governments and industries around the world. We will also delve into methodological and technical issues, ranging from applying LCA as a quantitative tool to using life-cycle concepts in decision-making.

This inaugural issue gives a general overview of international activity. Future issues will be more detailed. We invite you to send your story ideas, personal experiences using LCM tools, or general comments about *Ecocycle* to Kevin Brady, Head, Policies & Programs, Solid Waste Management Division, Environment Canada, Place Vincent Massey, 12th Floor, 351 St. Joseph Blvd., Ottawa, Ontario K1A 0H3.

canadian corner

ENVIRONMENT CANADA HAS BEEN INVOLVED WITH LIFE-CYCLE tools for the past three years, developing information sources, guidance documents and contributing to international methodology through peer reviews and participation in the Society of Environmental Toxicology & Chemistry (SETAC) workshops.

The life-cycle program's three-pronged approach includes monitoring international policies and practices, developing life-cycle tools and sharing information.

Monitoring International Policies and Practices. Environment Canada is involved in developing international guidelines and standards through the International Organization for Standardization (ISO) Technical Committee 207 on Environmental Management Standards. Canada's involvement is coordinated through the Canadian Standards Association (CSA) and the CSA Canadian Environmental Council, a multi-stakeholder body with a strong industry presence. A Federal Life-cycle Management Coordinating Committee has been established to tap expertise and data within different federal government departments, and to coordinate a position on national and international policy in life-cycle approaches.

Developing Life-cycle Tools. Environment Canada, the raw materials industries and the CSA are developing a Canadian Raw Materials Database to quantify all energy and raw materials inputs and environmental releases for the first two life-cycle stages: raw materials acquisition and primary processing. Materials include aluminum, steel, paper, glass, plastics and wood.

The database will help small and medium-sized businesses use life-cycle information to make internal improvements. Project partners are working with a consultant to draft an inventory methodology to ensure that the industry sectors use consistent collection methods, and a multi-stakeholder critical review panel will examine the methodology and results. Data collection should be completed by December 1995.

Environment Canada is also joining Forestry Canada (Natural Resources Canada), the CSA and the Canadian Pulp and Paper Association (CPPA) in a project to develop criteria for a Canadian-based life-cycle model to assess environmental impacts of pulp and paper production.

The Canadian Council of Ministers of the Environment (CCME) has published ***Environmental Profiles: Guidelines to Help Industry Meet the Goals of the National Packaging Protocol.*** It's designed to help small and medium-sized businesses analyze their operations and identify areas for environmental improvement. Focusing on in-house operations, it details a step-by-step method for inventorying resource and energy inputs, as well as waste outputs (solid, liquid and gaseous) that result from packaging and related activities.

Sharing Information. The CCME publication ***Sources of Data for the Life-cycle Analyses of Canadian Packaging Products*** describes the life-cycle stages of six commonly used packaging materials: aluminum, glass, paper, plastic, steel and wood. It identifies resource and energy inputs as well as waste outputs for each material's life-cycle, and discusses appropriate data sources and their applicability in various regions of Canada. It also advises users how to assess data quality by questioning how current, representative and reliable the data are.

For more information or free copies of Environment Canada documents please contact Environment Canada's Solid Waste Management Division at 1-819-997-3060; for copies of CCME documents, please contact the CCME Secretariat at 1-204-948-2090; or in Canada, the Waste Management Office of your provincial environment ministry.

WORKSHOP ON LIFE-CYCLE MANAGEMENT

- ❒ An introduction to life-cycle management (LCM) and life-cycle assessment (LCA)
- ❒ Domestic and international initiatives in LCM/LCA
- ❒ Evolving international LCM/LCA standards
- ❒ Public policy applications of LCM
- ❒ Using LCA to improve environmental performance in industry
- ❒ Implications for competitiveness and trade

Environment Canada is organizing a one-day workshop to provide information on these and related topics.

Date:	April 27, 1995
Venue:	Ottawa Congress Centre, Ottawa
For More Information:	Sara Melamed Marbek Resource Consultants, Ottawa Ph (613) 523-0784; Fax (613) 523-0717

international organizations

The Society of Environmental Toxicology and Chemistry **(SETAC)** is a professional society of individuals and groups studying environmental problems, and managing and regulating natural resources. It is involved in education and research and development.

The **SETAC Foundation for Environmental Education** has been a major developer of life-cycle assessment (LCA) methodology. Much of SETAC's approach to LCA has been adopted by the **International Organization for Standardization (ISO)** and many leading figures in SETAC participate in ISO.

A sister organization, **SETAC-Europe**, will soon release a publication on impact assessment. The SETAC Foundation for Environmental Education is expected to publish a report from their "Application of LCA to Public Policy Workshop" in early 1995.

The **ISO Technical Committee 207** (TC207) is developing a set of environmental management standards (ISO 14000 Series) similar to its ISO 9000 series of quality management standards. Standards now under development include those for life-cycle assessment, environmental labelling, environmental performance evaluation, environmental auditing, environmental management systems, and environmental aspects of product standards.

Five working groups collaborate in the ISO TC207 Subcommittee 5 (SC5), in charge of developing standards or guidelines on LCA. More than thirty countries currently participate in the areas of General Principles and Practices on LCA, Life-cycle Inventory Analysis, Impact Assessment and Improvement Assessment. Working Group 1 has released a committee draft, entitled **Life-cycle Assessment – General Principles and Practices,** to the ISO community for comment. ISO and the Comité européen des normes (CEN) – a European standards group – have formally agreed that any standard that ISO developed would automatically be considered as a potential European standard and could be referred to in European Union regulations.

The United Nations Environment Program (UNEP) has established a Working Group on Sustainable Product Development to promote more sustainable use of resources in products. This group will examine the life-cycle of products with emphasis on the impacts on, and the role of, developing nations.

The Organization for Economic Cooperation and Development (OECD) Pollution Prevention and Control Group has developed a work plan on life-cycle management and product policy for the next two years. It calls for an assessment of the use of life-cycle methods, to support public policy decisions and a review of current practice.

Ecocycle is published bi-annually by Environment Canada and delivered free of charge to national and international industry, government and non-government organizations interested in developments on life-cycle management tools and product policy.

Please forward questions or comments to: Environment Canada, Solid Waste Management Division, Ottawa, Ontario, Canada K1A 0H3.

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Fax: 1-819-953-6881
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publisher's message

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Environment Canada Environnement Canada

Canada

LCA scope and boundary setting

In principle, life-cycle assessment (LCA) covers *all* stages in the life-cycle of a product system, from "earth to earth". This includes extracting resources, processing them into materials and fuels, producing usable components, manufacturing a product, using and maintaining the product, and its final disposal.

In practice, though, we are limited by resources and time and must take steps to make a study manageable, practical and economical.

The first need when initiating an LCA is a clear **statement of purpose.** The study is defined to meet that purpose, within any constraints. Together, scope and boundaries encompass issues of depth and breadth, defining limits placed on the physical life-cycle and on the detail of information to be collected and analysed.

For example, an LCA done to help choose appropriate input materials for a small technical group within a company differs in purpose and scope from a study done to provide environmental information to groups outside the company.

Scope refers to the geographic, historical and technical applicability of a study: where data come from, how up-to-date the study is, how information is handled, and where the results are applicable. Within the scope, it is also necessary to allow for a critical review of the LCA.

The life-cycle system's **boundaries** are usually depicted in process flowsheets that show the main sequence of production: from resource to product to waste. The system must also include energy and ancillary materials that support the main production, and production of the ancillaries themselves. The whole life-cycle flowsheet resembles a tree with many roots and branches. Some may be interdependent, complicating analysis further.

Decision rules are used to determine which energy and ancillary inputs are significant enough to include, based on how much they affect the total environmental burdens or exhibit particular impacts.

Issues arise in setting precise boundaries.

For example, unlike mineral resources, raw materials derived from biological systems have no distinct upstream boundary. At what point does a living plant enter the industrial production system? When it is harvested from the earth? What about artificial inputs and outputs of water and nutrients? What about human actions involved in planting the crop or preparing the land, perhaps from a previous natural state?

Commonly, some processes in the life-cycle system generate more than one usable output. Secondary products are not of direct interest, but their production contributes to environmental burdens. Allocation is the technique of partitioning burdens between co-products; it is a boundary-setting activity that defines how secondary products in the system are treated when they leave the system.

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Environment Canada
Solid Waste Management Division
Ottawa, Ontario
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national government activity

THE NETHERLANDS' MAY, 1994 – POLICY DOCUMENT ON PRODUCTS AND THE ENVIRONMENT is based on the integrated life-cycle principle and the role of industry in supplying information about products' environmental impacts. The Dutch government is considering legislation to require different companies associated with a specific product system to provide data and environmental information for every stage in an item's manufacture.

Germany and **France** have very strong producer responsibility (product stewardship) policies for packaging. Recently, the German government also passed legislation called the *Life-cycle and Waste Management Act* enabling it to set targets and schedules for industry to implement product stewardship and life-cycle programs for products other than packaging. France awards the environmental label "NF-Environment", based on criteria developed from life-cycle inventory information.

Representatives of **Denmark, Norway, Sweden,** and **Finland** are on the **Nordic Council of Ministers.** The Council has initiated the **LCA-NORDIC** project to develop a Code of Practice for Life-cycle Analysis. The project, now in its second phase, will produce a manual containing a code of practice and guidelines for screening product life-cycle assessments for industry and other practitioners. The manual will also cover topics such as system boundary setting, cut-off criteria, allocations, data quality and impact assessment methods.

Sweden's environmental policy, established in its *Ecocycle Bill,* requires all decisions to be directed toward efficient management and to promote an "ecocycle" society with closed-circuit material flows. Ordinances passed in August and September 1994 require producers to take responsibility after use for packaging, newspapers, and tires. Life-cycle tools are being used to set waste reduction targets. The Swedish Waste Research Council has collaborated in developing an eco-design tool called the EPS system, using life-cycle inventory and impact assessment. This system has raised intense interest because it weighs and ranks environmental impacts and combines them to calculate a single number in environmental load units.

The **United States'** Environmental Protection Agency operates a research program from the Office of Research and Development's Risk Reduction Engineering Laboratory, aimed at improving life-cycle assessment methodologies and encouraging the use of life-cycle concepts in product and process design. Federal procurement authorities also use life-cycle management to select environmentally-preferable products when buying for the U.S. government.

Other national governments' involvement in life-cycle activities will be reported in future *Ecocycle* issues.

history of LCA

1960s and 70s Early energy analyses broadened to develop the Resource and Environmental Profile Analysis (REPA) – a quantitative methodology that formed the beginnings of life-cycle assessment (LCA).

1980s Little public interest in LCAs. However, work on product LCA methodologies and frameworks continued on a small scale.

1990 to 1994 Industry, government and academic interest in LCAs revived on an international scale. SETAC workshops were held to further develop LCA methodologies and practices.

Present Life-cycle concepts are now being used, both in quantitative LCAs, and in design, policy and regulatory decision-making.

Environmental Profiles case study

ENVIRONMENT CANADA IS LOOKING FOR PARTICIPATION from manufacturers with 500 employees or less in the application of Environmental Profile Guidelines. For information contact Steve Cross.
Tel: 1-819-953-0617
Fax: 1-819-953-6881

the life-cycle concept: backgrounder

THE LIFE-CYCLE CONCEPT IS A "CRADLE TO GRAVE" APPROACH to thinking about products, processes and services. It recognizes that all life-cycle stages (extracting and processing raw materials, manufacturing, transportation and distribution, use/reuse, and recycling and waste management) have environmental and economic impacts.

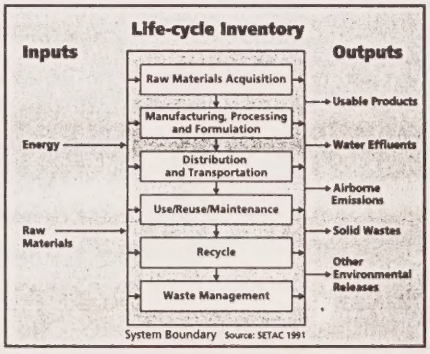
Public policy makers, industry and private organizations can apply the life-cycle concept to help them make decisions about environmental design and improvement. As well, the life-cycle approach can be used as a scientific tool for gathering quantitative data to inventory and, weigh and rank the environmental burdens of products, processes and services.

Unlike more specific "end of pipe" or "within the plant gate" approaches to environmental management, decision makers can apply the life-cycle approach to all of the upstream and downstream implications of site-specific actions. An example might be changes in emission levels that result from changing a raw material in the production process.

New and emerging life-cycle tools available to decision-makers include life-cycle assessment, design for environment, life-cycle cost accounting, total energy cycle assessment and total fuel cycle assessment.

Industry use of life-cycle assessment (LCA) as a tool to improve environmental performance is increasing. An LCA quantifies energy and resource inputs and outputs at all stages of a life-cycle, then determines and weighs the associated impacts to set the stage for improvements. Most attempts to develop life-cycle assessments have focused on the first two of four phases, namely, initiation and inventory analysis. A complete LCA study adds two further phases: impact assessment and improvement assessment.

The diagram below breaks down a product life-cycle inventory into inputs and outputs for material and energy, as well as environmental releases.



Further Reading

The Canadian Standards Association (CSA) released the world's first national LCA guideline, **Z-760 Environmental Life-Cycle Assessment,** in Spring, 1994. It is intended to assist industry in environmental decision-making, to aid in development of global environmental standards and to provide in-depth information on LCA methodology. It can be ordered at a cost of $92, plus shipping and handling, from: Standards Sales, CSA, 178 Rexdale Blvd., Rexdale (Toronto), Ontario, Canada M9W 1R3. Tel: 1-416-747-4044, Fax: 1-416-747-2475.

The LCA Sourcebook, A European Business Guide to Life-cycle Assessment is a reference for newcomers to the LCA field, or those particularly interested in European LCA activities and contacts. It outlines the benefits and limitations of life-cycle assessment and includes a guide to LCA studies, contact names and numbers, and publications. To order, contact: SustainAbility, Ltd., The People's Hall, 91-97 Freston Road, London W11 4BD, England.

For up-to-date information on current events and LCA developments, the **SETAC-Europe LCA Newsletter** can be obtained free from: SETAC-Europe, Av. E., Mounier 83, Box 1, 1200 Brussels, Belgium.

The SETAC Foundation of Environmental Education also publishes a newsletter available with a SETAC (North America) membership. For more information please contact: SETAC Foundation Office, 1010 North 12th Avenue, Pensacola, FL 32501.

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An example of co-products occurs when crude oil is refined into numerous hydrocarbon fuels and petrochemical feedstocks. It is usual to allocate the burdens of the refining and upstream processes based on calorific values of the different products. An alternative is to allocate burdens for co-products based on their comparative masses.

In LCA, as in any model, tension exists between accuracy and practicality. As we add details of breadth and depth, we also add complexity, expense and reduced utility. Ultimately, those who undertake LCA projects must make choices about scope and boundaries.